## AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Amended) A method for locating one or more transmitters within a search area using an array of antennas, the one or more transmitters transmitting signals having the same carrier frequency, and the array of antennas operating on a common clock signal, the method comprising the following steps:

(a) specification of a grid of possible grid point locations covering the search area, adjacent grid point locations being a distance equal to a predetermined fraction of the wavelength of the carrier frequency apart, said predetermined fraction being less than or equal to 1/8;

(b) establishment of a library of manifold vectors, one for each grid point location, describing the phase interrelationships between a hypothetical carrier frequency signal emanating from said grid point location and the signal as received by all antennas;

(c) reception and digitization of one or more signals by the array of antennas to determine snapshot vectors containing phase angles of arrival information for the one or more signals at each antenna;

(d) computation of a covariance matrix for the snapshot vectors over all antennas;

(e) combination of the covariance matrix or a submatrix thereof with each manifold vector in the library to create a virtual interference pattern for the one or more signals; and

(f) selection as possible locations for the transmitters those grid point locations where the associated value of the virtual interference pattern exhibits a maximum value, and exceeds a threshold representing ~~the~~ a null hypothesis;

whereby the possible locations for the transmitters have a precision of ¼ wavelength.

2. (Original) The method of claim 1 wherein the combination of the covariance matrix or a submatrix thereof with each manifold vector in the library is the orthogonal projection of each manifold vector onto the noise subspace of the covariance matrix, said noise subspace formed by singular value decomposition of the covariance matrix into its signal subspace and noise subspace components.

3. (Original) The method of claim 1 wherein the signals are generated by transmitters using a CDMA code, which CDMA code is used to separate the signal associated with each transmitter in a way that preserves the phase angle of arrival information for each such signal, whereby the method can locate transmitters independently and can locate more transmitters than antennas.

4. (Original) The method of claim 1 further comprising a step for estimating the number of signals received, and hence the number of transmitters being considered, by forming and averaging covariance matrices over time, whereby the method can determine the locations of a number of non-CDMA enabled transmitters transmitting at the same time equal to one less than the number of antennas in the antenna array.

5. (Original) The method of claim 1 wherein the signals are continuous wave signals.

6. (Original) The method of claim 1 wherein the signals are short duty cycle signals.

7. (Original) The method of claim 1 wherein antennas are added to the array to attenuate the effects of multipath propagation.

8. (Original) A system for locating one or more radio transmitters within a search area, the transmitters transmitting signals at a carrier frequency, the system comprising:

(a) a grid of possible grid point locations covering the search area, adjacent grid point locations being a distance equal to a predetermined fraction of the wavelength of the carrier frequency apart, said predetermined fraction being less than or equal to 1/8;

(b) an array of antennas positioned at infrequent intervals around the search area at known locations relative to the grid and operating on a common clock;

(c) a library of manifold vectors, one for each grid point location, describing the phase interrelationships between a hypothetical signal at the carrier frequency emanating from said grid point location and said signal as received by all antennas;

(d) means for detecting and processing the transmitter signals to extract a snapshot vector containing phase angle of arrival information of the transmitter signals at each antenna;

(e) means for computing a covariance matrix for the phase angle of arrival of the transmitter signals and for combining the signal covariance matrix with each manifold vector in the library to produce a virtual interference pattern;

(f) means for selecting one or more points in the virtual interference pattern that exceed a threshold as the locations for the signals of interest.

9. (Original) The system of claim 8 wherein the signals are generated by transmitters using a CDMA code, which CDMA code is used to separate the signal associated with each transmitter in a way that preserves determination of the phase angle of arrival for each such signal.

10. (Original) The system of claim 8 further comprising means for estimating the number of signals received, and hence the number of transmitters being considered, by forming and averaging snapshot vector covariance matrices over time.

11. (Original) The system of claim 8 wherein antennas are added to the array to attenuate the effects of multipath propagation.

12. (Original) The system of claim 8 wherein the means for selecting one or more points in the virtual interference pattern involves the orthogonal projection of each manifold vector with the noise subspace of the covariance matrix, said noise subspace formed by singular value decomposition of the covariance matrix into its signal subspace and noise subspace components.

13. (Original) The system of claim 8 further comprising a library of hypothesized signature vectors wherein the means for selecting the one or more

points in the virtual interference pattern involves comparing the corresponding points in the virtual interference pattern with the hypothesized signature vectors.

14. (Original) The system of claim 8 wherein the signals are continuous wave signals.

15. (Original) The system of claim 8 wherein the signals are short duty cycle signals.

16. (Amended) A method for locating one or more transmitters within a search area using an array of antennas, the one or more transmitters transmitting signals having the same carrier frequency, and the array of antennas operating on a common clock signal, the method comprising the following steps:

(a) specification of a grid of possible grid point locations covering the search area, adjacent grid point locations being a distance equal to a predetermined fraction of the wavelength of the carrier frequency apart, said predetermined fraction being less than or equal to 1/8;

(b) establishment of a library of manifold vectors, one for each grid point location, describing the phase interrelationships between a hypothetical signal at the carrier frequency emanating from said grid point location and the signal as received by all antennas;

(c) selection of a signature of known grid point locations positioned relative to a grid point in question;

(d) establishment of a library of hypothesized signature vectors, one for each grid point location, the elements of the signature vector corresponding to the signature of known grid point locations, and the value of each element of the signature vector being a combination of the manifold vector at the

grid point location in question to the manifold vector at the grid point location corresponding to said element;

(e) reception and digitization of one or more signals by the array of antennas to determine snapshot vectors containing phase angles of arrival information for the one or more signals at each antenna;

(f) computation of a covariance matrix for the snapshot vectors over all antennas;

(g) combination of the covariance matrix or a submatrix thereof with each manifold vector in the library of manifold vectors to create a virtual interference pattern for the one or more signals;

(h) comparison of the library of signature vectors with corresponding values of the virtual interference pattern and selecting as the possible locations for the transmitters those matches that exhibit a maximum value, and are greater than a threshold representing ~~the~~ a null hypothesis;

whereby the possible locations for the transmitters have a precision of ¼ wavelength.

17. (Original) The method of claim 16 wherein the signals are generated by transmitters using a CDMA code, which CDMA code is used to separate the signal associated with each transmitter in a way that preserves determination of the phase angle of arrival for each such signal, whereby more the method can locate transmitters independently and can locate more transmitters than antennas.

18. (Original) The method of claim 16 further comprising a step for estimating the number of signals received, and hence the number of transmitters being considered, by forming and averaging snapshot vector covariance matrices over time.

19. (Original) The method of claim 16 wherein the signals are continuous wave signals.

20. (Original) The method of claim 20 wherein the signals are short duty cycle signals.

21. (Original) The method of claim 16 wherein antennas are added to the array to attenuate the effects of multipath propagation.

22. (Amended) An antenna array for ~~detecting~~ locating one or more transmitters transmitting at a carrier frequency within a search area at a resolution of ¼ of the wavelength of the ~~transmitter signal~~ carrier frequency, the search area identified by a grid of possible grid point locations wherein adjacent grid point locations ~~being~~ are a distance less than or equal to 1/8 of the wavelength of the carrier frequency ~~of the transmitter signal~~ apart, the antenna array comprising:

(a) a number of antennas positioned ~~at infrequent intervals~~ about the search area, at known locations relative to the grid, and operating on a common clock;

(b) means for computing a library of manifold vectors, one for each grid point location, describing the phase interrelationships between a hypothetical transmitter signal emanating from ~~said~~ each grid point location and said signal as it would be hypothetically received by all antennas;

(c) means for computing one or more calibration covariance matrices, each calibration covariance matrix representing a modeled response of the antenna array to a modeled transmitter signal emanating from a calibration transmitter location within the search area;

(d) the number of antennas sufficiently large that for ~~each hypothetical transmitter signal~~ all calibration transmitter locations in a set of calibration transmitter locations, a combination of the ~~covariance matrix with each manifold vector~~ calibration covariance matrix corresponding to a particular calibration transmitter location in the set with the library of manifold vectors creates a virtual interference pattern for the antenna array having a unique ~~outlier for each hypothetical transmitter signal~~ maximum at the grid point location ~~associated with said hypothetical transmitter signal~~ nearest to the particular calibration transmitter location.

23. (Amended) The antenna array of claim ~~22~~ 24 wherein antennas are added to the array to attenuate the effects of multipath propagation.

24. (New) The antenna array of claim 22 wherein the set of calibration transmitter locations has at least one calibration transmitter location at a distance of no more than 1/16 of the wavelength of the carrier frequency away from each grid point.

25. (New) The antenna array of claim 24 wherein individual antennas are repositioned to increase linear independence of the library of manifold vectors.

26. (New) The antenna array of claim 24 wherein the number of antennas is sufficiently large such that the difference between the unique maximum and a next largest value in the virtual interference pattern exceeds a threshold representing a null hypothesis.